

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): C.-S. Li et al.
Case: YOR920010407US1
Serial No.: 09/896,584
Filing Date: June 29, 2001
Group: 3627
Examiner: Asfand M. Sheikh

Title: Methods and Apparatus for Automatic Replenishment of Inventory
Using Embedded Sensor System and Electronic Marketplace

AFFIDAVIT UNDER 37 C.F.R. §1.131

We, the undersigned, hereby declare and state as follows:

1. We are named joint inventors of the invention that is the subject of the above-referenced U.S. patent application.
2. The invention was conceived and reduced to practice at some time prior to May 1, 2001. Prior to May 1, 2001, the named inventors prepared an internal IBM invention disclosure document entitled "Method and Apparatus for Automatic Order Placement and Fulfillment of Merchandise Using Embedded System and Marketplace." A copy of the above-mentioned document is attached hereto as Exhibit 1.
3. Applicants' attorney, Mr. William E. Lewis of Ryan, Mason & Lewis, LLP, received the above-mentioned document on or about May 1, 2001 in a letter from IBM Corporation (assignee) with instructions to prepare and file a U.S. patent application based on the above-mentioned document. A copy of the letter is attached as Exhibit 2.

4. Applicants' attorney, Mr. William E. Lewis, sent a draft of the above-referenced U.S. patent application to inventor Chung-Sheng Li on June 22, 2001 under cover of a facsimile cover sheet. A copy of the facsimile cover sheet is attached hereto as Exhibit 3.

5. The invention was constructively reduced to practice by filing the above-referenced patent application on June 29, 2001.

6. All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true.

7. We understand that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 02/14/2007


Chung-Sheng Li

Date: 02/14/2007



Mahmoud Naghsbshineh

EXHIBIT 1

**Method and Apparatus for Automatic Order Placement & Fulfillment of Merchandise
Using Embedded system and Marketplace**

Abstract

More and more devices such as (1) home appliances (refrigerator, microwave oven, home entertainment system, etc.), (2) shelves in the retail store, (3) shelves in the warehouse (4) office supply shelves in offices, and (5) supplies tray in office machines (fax, printer, copier, etc.) will have smart sensors and embedded systems which enable the appliance or shelves to be able to provide real-time status of the current "inventory". The output from these sensors can then be connected through the wireless network (Bluetooth, HomeRF, 802.11, CDPD, GPRS, etc.), home network (Bluetooth, Home RF, P1394, Ethernet), or local area network (802.11, Ethernet, etc.) to an messaging system so that the administrator/user can be alerted or to the inventory control system so that re-ordering can take place.

In this patent application, we disclose methods and apparatus that enable generating anticipatory alerts or ordering requests, so that a recommendation alert for replenishing or a direct order can be placed under the best market condition.

Field of the Invention

.This invention intends to address the area of producing automatic replenishing of inventory through the use of remote sensors collecting information through gateways. Furthermore, brokers will aggregate and deaggregate these information/orders, and leverage the market condition This invention also address the area of automatic generation of recommendation of new brand and/or new type of merchandise to the end consumer.

Description of the Prior Art

Although automatic replenishment has been discussed in the home environment such as replenishing soda when the inventory is low, the mechanisms have not been considered in the marketplace context. Similarly, there have been proposals regarding to generating automatic alerts when equipments are about to have trouble. This has not been considered in the context of a market mechanism either. Most of the systems that have been considered or proposed for generating alerts and/or ordering requests when the inventory reaches a pre-established threshold. This threshold is usually set based on the consideration of the time it takes to replenish the inventory. To our best knowledge, no prior art exist to take advantage of the market or marketplace conditions.

Prior work also includes the development of supply chain optimization in which the optimal replenishing schedule is generated for raw materials or office supply. This is often referred to as just-in-time replenishing. This is different than what we discussed here in which the sensors are generating the inventory level. Furthermore, supply chain environment is not often used in a marketplace environment.

Summary of the Invention

The proposed apparatus consists of the following major components:

- **Sensor and embedded system:** the sensor can be a bar code scanner, an RF tag scanner, or other types of RF or optical based sensors. The sensor output will go through an Analog-to-Digital (A/D) Converter, and captured by the memory of the embedded system. The microprocessor of the embedded system will then package these sensory data and send to a repository within home or any institution.
- **Home network & gateway:** The networking infrastructure allows the sensory data to be deposited and forwarded through the home network gateway to a hosted broker.
- **Hosted broker:** The hosted broker is responsible for monitoring the pricing and supply trends of the major emarketplaces on a set of items, and calculate the optimal entry point for replenish supplies.
- **Electronic Marketplaces:** The electronic marketplaces allows people to openly placing bids and offers of the items, and allowing the use of various pricing mechanism to discover the true "value" of a certain item based on the equilibrium of supply and demand.

The proposed method includes the following steps in order to satisfy the following criteria:

- **Continuous supply** - the supply shall rarely reach zero for an extended period of time, and the tolerance for zero supply will be individual, family, or institution-dependent.
- **Nearly minimal "running" cost** - by taking advantage of the pricing and supply information from interoperable emarketplaces to achieve a minimal expenditure for the continuous operation.

- Human touch: by injecting new brands/selection based on the previous usage - dynamic exploring of new space
- Machine-to-machine: nearly zero human intervention.

As a result, the objective is to optimize the average cost function (over a period of time) subject to constraints of nearly continuous supply.

The proposed methods to be executed by the hosted broker include:

- Gathering the following information
 - usage pattern of a particular item through the smart sensor through the home network gateway - the result can be expressed as a time series
 - the market condition of the item from interoperable electronic marketplaces, in terms of supply and pricing - the result can also be expressed as a number of time series
- Generate rules for sending alerts or ordering
 - when the inventory becomes low, or
 - when market condition reach new lows and there are sufficient shelf space

Brief Description of the Drawings

These and other features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, wherein:

Fig. 1 illustrates the structure of sensors connected through gateway and brokers to an electronic marketplace for trading with those providers which are also connected to the electronic marketplace.

Fig. 2 illustrates the structure of sensors connected through gateway and broker in a buy-side private marketplace.

Fig. 3 illustrates the structure of sensors connected through gateway and broker in a sell-side private marketplace.

Fig. 4 illustrates the process of leveraging the inventory and market condition (present and the past) to determine the optimal timing and quantity for replenishing inventory.

Fig. 5 illustrates the process of automatic generation of recommendations for new brands/types of merchandise in this environment.

Fig. 6 illustrates the process that the embedded system, the hosted brokers, and the emarketplace are trying to optimize with respect to their individual objectives independently while an equilibrium is reached.

Description of the Preferred Embodiment

Figure 1 illustrates the overall structure of the disclosed apparatus. The sensors (101) can be in the following forms:

- Embedded environment, such as those embedded sensors in an
 - Automobile for sensing the temperature, speed, pressure, etc.,
 - Home appliance, such as those in a refrigerator, microwave oven, air conditioner, home safety alarm system, or the boiler,
 - Computer peripherals, such as printer, fax, copier machine, etc.
- Sensors for acquiring audio, images, and video
- RF tags (usually attached to a merchandise) for declaring its content when illuminated with microwave

The information collected from these devices can be collected by a computer via a gateway (102). This is usually the case for the home environment, where a few computers are responsible for collecting a wide variety of information. Once the information is collected by a computer through the gateway, the information can then be sent to the broker (103). On one extreme, the information can be just the current condition of the device that the sensor it is embedded in, the inventory level. On the other extreme, the information can be a request for replenishment. The broker is responsible for aggregating or deaggregating the orders potentially received from multiple gateways, and placing the order in the marketplace (104), so that those providers (105) of the goods can respond to those orders.

Figure 2 illustrates the structure of going through a private buy-side marketplace to place an order. A private buy-side marketplace implies a marketplace with single-buyer and multiple providers. Similar to Figure 1, the information collected by the sensor (201) through the gateway

(202) and sent to a broker (203). The broker may aggregate orders from multiple gateways, and place the order base on a model which invites competitive bids from the providers (205) through a private marketplace (204). This situation usually apply to the case when the broker is a dominant player - such as the regional Bell company (Verizon, SBC), AOL/Time Warner, or ADT home security system. AOL/Time Warner is the dominant Internet service provider, ADT is the dominant home security system provider, and regional Bell company is the dominant local phone service providers. All of these providers have large customer base and wiring in place to wire all of the homes of the customers. As a result, this guarantees the size of the market and generate incentives for the providers to participate.

Figure 3 shows the structure of a private sell-side marketplace. A private sell-side marketplace implies a private marketplace of a single-seller and multiple busyers. Similar to Figure 1, multiple brokers (303) collect information (inventory levels, orders) from the sensors (301) through the gateway (302). These brokers will place the orders to the same provider (305) through the marketplace (304) set up by the provider. This kind of marketplace is usually set up for major providers of parts and merchandise, such as the toners for HP printers, Xerox/Kodak copiers, etc.

Figure 4 illustrates the process for setting up the ordering by the sensor through a marketplace. In this case, the sensor collects the instantaneous information such as the inventory level or the current condition of the device/equipment that the sensor is embedded. The information, which can be used to generate the usage pattern, becomes a time series (401). The market condition is also monitored and collected into a time series (402). Models can be developed to characterize and predict the usage pattern and market condition. If the inventory level is less than full, the market condition is checked (404) to determine whether any action

shall be taken. If the autonomous mode (405) is ON, an order is placed (406) when the condition is appropriate. When the autonomous mode (405) is OFF, an alert (407) will be sent to a proxy or a person who can take action. Note that the purpose of the end client is to maintain continuous supply with minimal running cost. As a result, the models for the usage and the market fluctuation will be exploited so that the optimal order placement **timing** and **quantities** can be generated.

Figure 4 provides inventory replenishment as if in a supply chain environment. However, innovation and change is common in a consumer-centric environment - as we usually try different brands of consumer product, or different types of consumer products from the same brand. Figure 5 illustrates automatic mechanism to introduce new items in such an automatic replenishment environment. The user preference is collected (501) either explicitly - such as through the specification of user profile, or implicitly - such as through the mining usage behavior. A set of recommendations (502) of new brands (504)/items (505) can then be generated based on these explicitly or implicitly generated rules. This recommendation generation step (502) is similar to the collaborative filtering processes such as those used by Amazon for promotion, upsale, and cross-sale. A small quantity of the recommended merchandise is then ordered. The usage pattern of these newly ordered items will be monitored and the result will be used to revise the user profile.

Figure 6 illustrates the distributed nature of the optimization objectives used by the embedded systems (601), the hosted brokers (602), and the marketplace (603):

- The embedded system try to maintain continuous supply while maintaining minimal running cost (604),

- The hosted brokers try to minimize the overall purchasing price (605) either through aggregation (and thus leveraging the volume discount when available), or deaggregation (to leverage different price demand curve from the providers)
- The emarketplace will perform the matchmaking process among the consumers and providers of the goods and will try to maximize the long-term profit (or welfare) of the entire community consisting of the providers and consumers of the goods (606).

Although these entities have their own objectives, they will be interact through the marketplace using the regular market mechanism (fixed-price, dynamic pricing) with a common winner determination and price signaling process (607). In the extreme form of this process, there is no need for the human intervention. The entire process of trading can be entirely autonomous (or machine to machine - M2M).

Now that the invention has been described by way of a preferred embodiment, with alternatives, various modifications and improvements will occur to those of skill in the art. Thus, it should be understood that the detailed description should be construed as an example and not a limitation. The invention is properly defined by the appended claims.

1.

Claims

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A system (and method) for machine-to-machine commerce, comprising:
 - a. means for receiving from a client a signal generated by an embedded sensor system, the signal indicating an inventory of items on hand at the client's location;
 - b. means for procuring additional such items for the client depending on the current price of such items on the market.
2. The system of claim 1, wherein the signal further includes information about the history of inventory of such items at the client's location.
3. The system of claim 1, further comprising receiving signals from a plurality of clients whereby items can be procured for a plurality of clients simultaneously whereby to realize the benefits of volume purchasing.

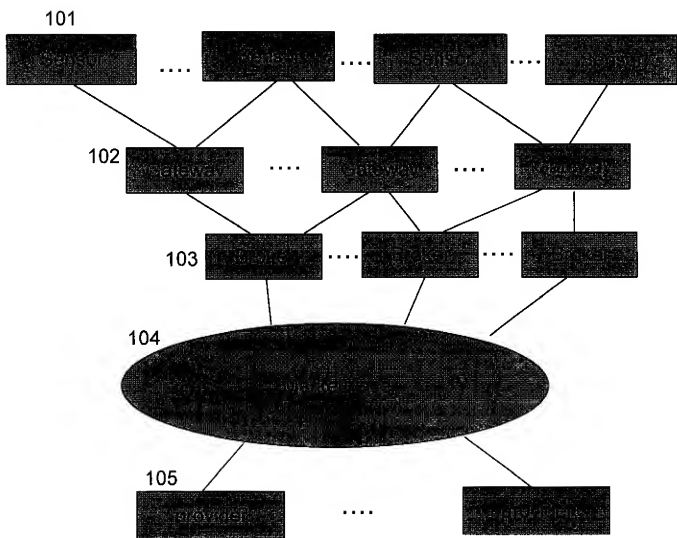


Figure 1

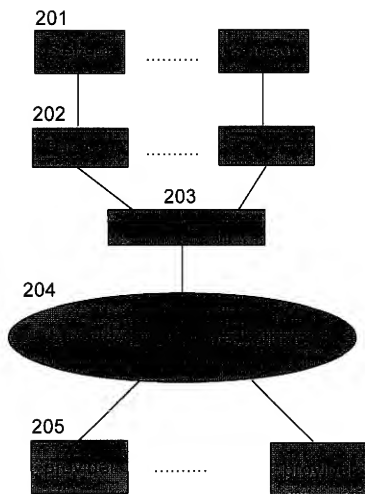


Figure 2

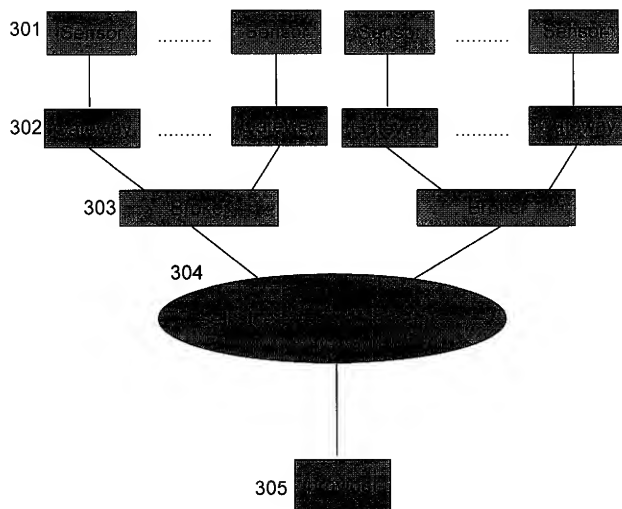


Figure 3

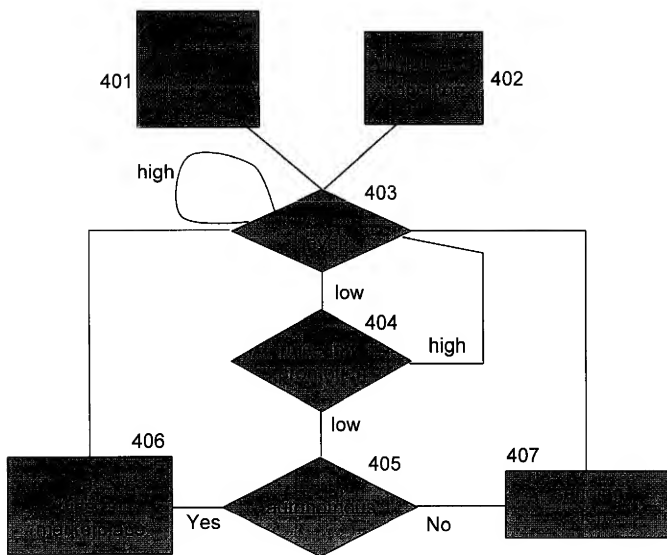


Figure 4

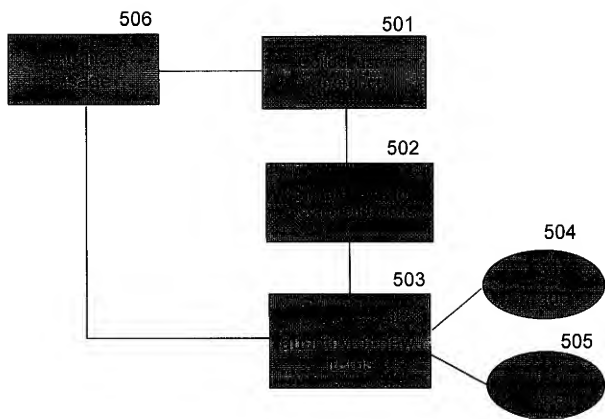


Figure 5

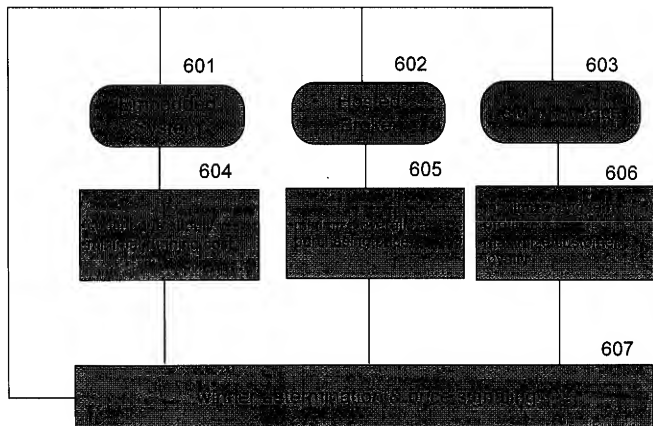


Figure 6

EXHIBIT 2



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May 1, 2001

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RECEIVED
WITH THANKS
RYAN, MASON & LEWIS, LLP
JmH 5-4-01

Re: YOR920010407US1

"Method and Apparatus for Automatic Order Placement and Fulfillment
of Merchandise Using Embedded System and Marketplace"

Dear Bill:

Please prepare a U.S. Patent Application for filing in the U.S. Patent and Trademark Office for the above referenced docket. We wish that the application be filed no later than June 30, 2001, so that the application can qualify for an IBM incentive award. This application is to be prepared in accordance with the IBM Outside Counsel Instructions in EPC format. Please include a Beauregard claim.

It is desired that this office be informed at all points involving scope of coverage and financial decisions. We wish that you handle the preparation and filing of all formal papers. Please note that the following paragraph should be used for the Power of Attorney.

POWER OF ATTORNEY: As a named inventor I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (list name and registration number).

Manny W. Schecter (Reg. 31,722), Lauren Bruzzone (Reg. 35,082), Christopher A. Hughes (Reg. 26,914), Robert P. Tassinari, Jr. (Reg. No. 36,030), John E. Hoel (Reg. 26,279), Joseph C. Redmond, Jr. (Reg. 18,753), Paul J. Otterstedt (Reg. 37,411), Douglas W. Cameron (Reg. 31,596), Stephen C. Kaufman (Reg. No. 29,551), Daniel P. Morris (Reg. No. 32,053), Louis J. Percello (Reg. No. 33,206), Marian Underweiser (Reg. No. 46,134), Robert M. Trepp (Reg. No. 25,933), Derek S. Jennings (Reg. No. 41,473), Louis P. Herzberg (Reg. No. 41,500), Richard M. Ludwin (Reg. No. 33,010), Marc A. Ehrlich (Reg. No. 39,966), Gail Zarick (Reg. No. 43,303), Timothy M. Farrell (Reg. No. 37,321)

Enclosed herewith are materials for use in preparing the application.

Send Correspondence to: Outside Counsel

Direct Telephone Calls to: (name and telephone number) Outside Counsel

An Associate Power of Attorney form should be prepared and forwarded to this office for signature.

Please be advised that an additional step in our procedure is required when filing ALL original IBM Yorktown Patent Applications in the USPTO. The additional step is that a "Taiwan Oath & Assignment" form must be completed. The form must have all the required information completely filled in and must be signed and dated by all named inventors in the subject patent application. When the form is complete, and all inventor(s) signatures and dates have been obtained, please forward the original Taiwan Oath & Assignment back to my office.

Please have your illustrator prepare formal drawings for the applications. The docket number on the drawings must be consistent with the docket number on the application. In the event these applications are filed with informal drawings, please provide us with formal drawings within six weeks after the filing date. Should you have any questions regarding the preparation of formal drawings, please contact me.

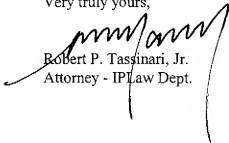
Inventor contact:

Chung-Sheng Li

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If you have any questions or comments, please feel free to contact me at (914) 945-2631.

Very truly yours,


Robert P. Tassinari, Jr.
Attorney - IPLaw Dept.

/esf
enclosure

Cc: Barbara Rasa

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EXHIBIT 3

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Facsimile: (516) 759-9512
Email: wel@rml-law.com

DATE: June 22, 2001

FILE: YOR920010407US1

Facsimile Message From: **WILLIAM E. LEWIS**

Please deliver the following pages to:

NAME: Chung-Sheng Li

OF: IBM Corporation

FAX NUMBER: (914) 784-6024

NUMBER OF PAGES INCLUDING THIS COVER PAGE: 30

COMMENTS/INSTRUCTIONS:

Dear Chung-Sheng:

Please find attached a draft patent application relating to your automatic inventory control system. I kindly request that you review the draft and provide me with your comments as soon as possible. As you know, we plan to file this case on or before **Friday, June 29, 2001**. Please confirm receipt. Thank you for your assistance with this case.

Best regards,



Bill Lewis

If you do not receive all of the pages, please call us back as soon as possible at (516) 759-2946.

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